（課程博士・様式７）（Doctoral qualification by coursework,Form 7）

学 位 論 文 要 旨

Abstract of Doctoral Thesis

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論文題目：
Title of Thesis：A RESEARCH ON STEM EDUCATION THEORY AND PRACTICES METHOD IN JAPAN AND INDONESIA USING MULTIPLE INTELLIGENCES APPROACH

論文要旨：
Abstract：

This research was driven by the demands of the 21st century that stimulate educational reform. In Japan, according to a survey commissioned by MEXT, an additional 0.16 million researchers and 1.09 million engineers will be required by 2030 in order to preserve an annual economic growth rate of 2 percent (MEXT 2008). Due to declining fertility rates and rapid aging of the population, they are wondering whether or not this demand could be fulfilled in the future. MEXT introduced new special programs for improving literacy (MEXT 2010). One of the programs is improving STEM education development, many of the programs implemented by the Japanese government to improve STEM education in schools. However, they lack evidences of STEM education implementation in public schools or informal classes. On the other hand, Indonesia will need 113 million skilled workers by the year of 2030. Thus we need to strengthen the quality and the relevance of education because it is critical to economic and social development (Ministry of Culture and Education, 2013). The government published new curriculum, so-called the “2013 National Curriculum”. The government has not implemented this reform in all regions; it has been carried out in specific areas and responses are being collected from educational practitioners. Teachers criticize this curriculum because of the thematic content, which requires them to think holistically in order to teach lessons. In other words, teachers need to integrate all subjects into a class to achieve the core competencies in students. In fact, the answer to what is the best methodology to achieve the purpose of the curriculum has not been studied yet. Therefore STEM education implementation assumed could help fulfill the demands of both countries.

Implementations of STEM education was conducted at informal settings through STEM camp activities in Japan, and at formal setting through a teacher training and class activities in Indonesia. The diversity of students’ intelligences was considered in these studies. The goals were to increase STEM knowledge and interests, creativity skill, and self-development

without ignoring students' multiple intelligences (MI). Data of study consist of students' MI profile, students' knowledge, students' creativity skills, and students' response (interest, agreement, perception) of STEM education. First, multiple intelligences (MI) profile were collected using "MI Quiz" that developed by Walter McKenzie (1999) and "How Many Intelligences Are You Dominant" that adapted from Laura Candler (2011). Second, students' knowledge data were collected from mind map of *tsunami*, concept map of natural hazard disaster, and science final examination. Third, creativity skills data were collected from solution designs and "Torrance Test of Creative Thinking" results. Finally, the responses were collected using "STEM Implementation Questionnaire" that adapted from Berlin & White (2010). Samples of these studies consisted 152 Japanese students and 632 Indonesian students.

The impacts of the implementation described in the results analysis that showed increases of STEM knowledge after camp activities in Japan (34.75 in average), and after class activities in Indonesia that higher than the traditional classes (experiment class = 77.93 in average, control class = 74.33). Most (90.8%) of the students put more interests in STEM learning, and changed their perspectives of STEM contents after camp activities significantly (pre = 2.58, post= 2.88), however they were most interested in science (3.63) than other disciplines. Moreover, Indonesian and Japanese teachers changed their perception toward science, engineering, mathematics, STEM career, and STEM integration after the training program significantly ($W_{ov} > W_{cv}$), except toward technology. The additional influence resulted in improvement of creativity skills and multiple intelligences profile in some implementation activities. In addition, there were some facts of Japanese students' multiple intelligences profile that showed the modest and humility of estimating themselves compare to Indonesian students. This finding coherent to A. Furnham (2008) that showed Japanese student estimations of their own MI were lower than other countries.

However, based on the evaluation rubric, the implementations met some challenges such as: 1) in integrating technology (T) and engineering (E) into science (S) and mathematics (M) activities that arrived from the lack of STEM area recourses and professionals; and 2) in using STEM contexts because lack of coherency school curriculum to STEM education program characteristic that arrived from unsupported local school policy. Therefore, STEM area resources and professionals should be improved through a periodic professional development of STEM education, and the collaboration among STEM area professionals should be involved in order to enrich the resources and to share the perceptions. This suggestion is coherent to Stohlmann, et al (2012) who thought, "*there is a need for further research and discussion on the knowledge, experiences, and background that teachers need to effectively teach integrated STEM education*". Moreover, agreements with schools samples to apply STEM education based curriculum should be achieved in order to improve using of STEM contexts.